Trend Study 10-5-05

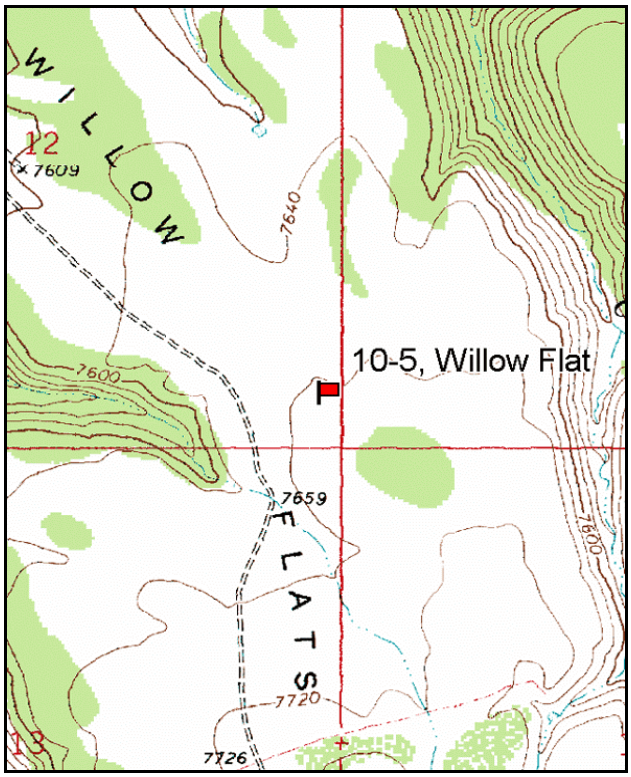
Study site name: Willow Flat . Vegetation type: Mountain Big Sagebrush .

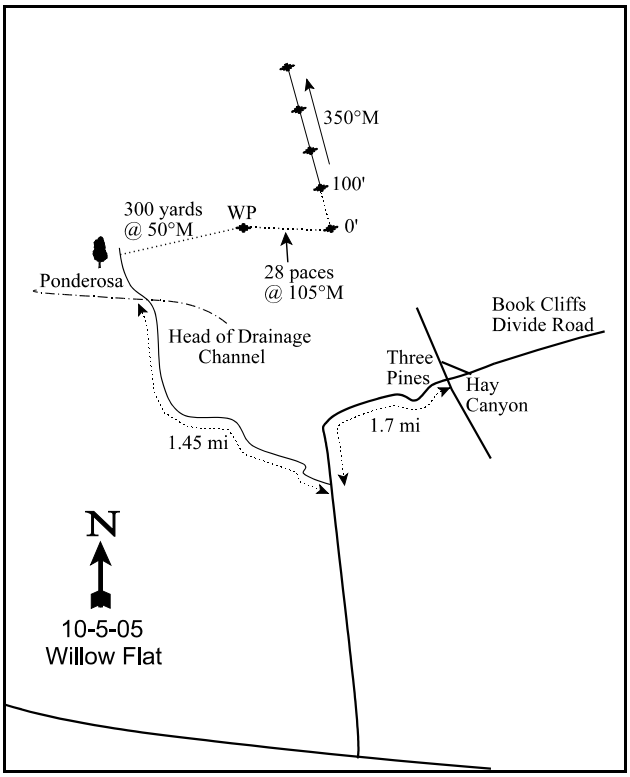
Compass bearing: frequency baseline 350 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From the intersection of the Seep Ridge and Book Cliff Divide road, proceed west along the divide for 9.4 miles to the major Three Pines - Hay Canyon intersection. Continue straight for 1.7 miles to a road to the right to Willow Flat. Turn right here and go 1.45 miles until you see a large ponderosa pine (with other conifers at the head of a small canyon) on the left side of the road. From the ponderosa, walk 300 yards at 50°M to a full high witness post. From the witness post walk 28 paces at 105°M to the 0-foot baseline stake. The frequency baseline is marked by green steel fenceposts, 12 to 18 inches in height.





Map Name: Cedar Camp Canyon Diagrammatic Sketch

Township 16S , Range 22E , Section 12 GPS: NAD 27, UTM 12S 4364798 N, 635034 E

DISCUSSION

Willow Flat - Trend Study No. 10-5

The Willow Flat trend study samples state owned land and is similar to study number 10-4, Wirefence Point. The elevation is 7,700 feet with a slight westerly aspect on nearly level terrain. This area was sprayed to kill sagebrush sometime prior to 1982. As of fall 2005, the permittee of this area on State Trust Lands has proposed to retreat the area by spraying or perhaps harrowing, but is still awaiting funding. This site is used by deer, elk and livestock during the summer. Elk may use this area during mild winters. A pellet group transect data from 2000 estimated 6 deer days use/acre (15 ddu/ha), 32 elk days use/acre (79 edu/ha), and 8 cow days use/acre (20 cdu/ha). In 2005, elk use was estimated at 31 elk days use/acre (76 edu/ha) and deer use was 4 deer days use/acre (10 ddu/ha). Some cow pats from previous years were noted. Wild horses also use this area.

Soils at the site are of clay loam texture. Effective rooting depth is estimated at nearly 13 inches. Soil pH is neutral at 7.1. Phosphorus is very low at 1.8 ppm (Tiedemann and Lopez 2004). The soil appears to be fairly uniform in depth down to 13 inches with a hard pan being present below that. This layer may be restrictive to roots. Erosion appeared to be light with some evidence of pedestaling and overland flow being noted in 2000. Most of the shrub interspaces are bare while the majority of the preferred herbaceous species are protected under shrub crowns. A small gully exists near the site, but appeared to be healing with grasses and forbs becoming established in 2000. In 2005, an erosion condition class assessment rated erosion as slight. Pedestaling and rills up to one inch deep were evident.

Mountain big sagebrush is the dominant species on the Willow Flat site, even after being sprayed in the early 1980's. When the study was established in 1982, there was a high percentage of dead sagebrush from the original spraying treatment, especially along the baseline, but there were many “safe sites” for shrub establishment as evidenced by a very large number of sagebrush seedlings (5,200 per/acre) in 1982. Density was estimated at 2,533 plants/acre, with 87% of these being mature. In 1988, estimated sagebrush density increased sharply to 16,800 plants/acre, due to an sudden increase in the number of young plants (15,200 plants/acre). There were only 1,400 mature plants/acre in 1988. Estimated sagebrush cover in 1988 was 8%. Density in 1995 was 8,840 plants/acre, 43% of which were classified as young. The number of mature plants increased to 4,920 plants/acre, indicating a more stable population. This change in sagebrush density and age class composition from 1988 to 1995 can be attributed in part to the much larger sample size utilized in 1995 which better estimates browse populations with clumped and/or discontinuous distributions. In 1995, decadence remained low, vigor was good, and use on sagebrush was mostly light. In 2000, the sagebrush population was estimated at 10,060 plants/acre, with continued high recruitment from the young age class (29%). Although decadence increased from 1% to 15%, vigor remained good, and use remained light to moderate. Density, in 2005, declined to 7,580 plants/acre. Mature and decadent plant density did not change from 2000. The number of young plants/acre decreased from 2,940 in 2000 to 560 in 2005. This decline of young plants is probably due to drought conditions and competition with the mature plants. As this population has matured after the spray treatment, cover has increased with each reading. Cover was 16% in 1995, 20 % in 2000, and 25% in 2005.

Dwarf rabbitbrush is also abundant. These short prostrate shrubs have declined from a high of 10,599 plants/acre in 1982 to 4,240 in 2005. This large change in density could be because of the much larger sample size, especially better for species that have clumped distributions. Use remains light to moderate on dwarf rabbitbrush as was the case in 1995. Other browse encountered on the site include rubber rabbitbrush, low rabbitbrush, broom snakeweed, and snowberry, but none of these are particularly abundant.

Pinyon and juniper trees appear to be encroaching into the sagebrush flat, with trees still relatively sparse. This can be seen by comparing photos from 1988 and 2005. Point-center quarter data from 2000 estimated 7

pinyon and 27 juniper trees/acre. Most of these were 5-6 feet in height. In 2005, tree density increased to 21 pinyons/acre and 55 junipers/acre. Sixty-one percent of the junipers sampled were between 4 and 8 feet tall. Average juniper diameter decreased from 6.0 inches in 2000 to 3.9 inches in 2005, which indicates a younger encroaching population.

The most abundant grasses include: thickspike wheatgrass, mutton bluegrass, Sandberg bluegrass, and prairie junegrass. Sum of nested frequency for perennial grasses declined 27% in 2005. Forbs have been numerous and diverse at the Willow Flat site. Thirty-nine species, most of which are perennial, have been sampled in at least one reading since 1988. However, due to drought, forbs declined in both 2000 and 2005. This is a concern as these herbaceous species are important on this summer range. The abundance of forbs should increase with the return to normal precipitation patterns.

1982 APPARENT TREND ASSESSMENT

Soil trend appears stable but somewhat precarious. The heavy rains that occurred throughout the summer of 1982 may have resulted in above normal erosion. The site appears to be returning to sagebrush dominance at a fairly rapid rate. To a point, this is desirable, but hopefully density can be curtailed enough that good grass cover can be maintained and a variety of desirable forbs can develop.

1988 TREND ASSESSMENT

Basal vegetation cover increased in 1988 which is consistent with the change in the herbaceous understory composition. Percent litter cover declined slightly, but percent bare soil has remained about the same. Trend for soil is considered stable even with the increase in frequency of grasses and forbs. The browse trend is up for the key species mountain big sagebrush. The number of mature shrubs actually declined from 2,200 plants/acre to 1,400. However, the number of young increased from 333 plants/acre to 15,200 indicating a young expanding population. Dwarf and low rabbitbrush populations follow the same general trend. Trend for herbaceous species is also up. Quadrat frequency of grasses and forbs has doubled since 1982.

TREND ASSESSMENT
soil - stable (0)
browse - up (+2)
herbaceous understory - up (+2)

1995 TREND ASSESSMENT

Ground cover characteristics have remained similar to those of 1988. The biggest difference is in the decline in percent litter cover, which has occurred statewide with the drought. Trend for soil is stable. Trend for browse is still up for the key species, mountain big sagebrush. Total density has declined since 1988, however the number of mature plants has increased from 1,400 to 4,920 plants/acre. Seedlings and young are still abundant while percent decadence is only 1%. Use is light and vigor is good. Dwarf rabbitbrush displays a similar trend. Quadrat frequency of grasses and forbs doubled between 1982 and 1988. Since 1988, sum of nested frequency of grasses has declined while that of forbs has increased. Overall, sum of nested frequency of grasses and forbs combined has remained stable. Although this site is primarily summer range it can be used by elk in mild winters. The Desirable Components Index (see methods) rated this site as good winter range due to good shrub cover and a healthy herbaceous understory.

TREND ASSESSMENT
soil - stable (0)
browse - up (+2)
herbaceous understory - stable (0)
winter range condition (DC Index) - good (78) Mid-level potential scale

2000 TREND ASSESSMENT

Trend for soil is slightly down with the relative percent cover of bare ground increasing from 31% to 41% in 2000. Also, the ratio of protective ground cover to bare soil decreased due to a decline in nested frequency of herbaceous plants and an increase in nested frequency for bare soil. There is also evidence of overland water flow occurring with many of the shrub interspaces being bare. Trend for browse is slightly up with more than a 13% increase in number of mature plants in the population. The key species, mountain big sagebrush, increased in decadence from 1% to 15%, however this increase is within reasonable limits for sagebrush. Recruitment remains high at 29%, vigor is good, and use remains light to moderate. Trend for grasses is stable, but down for forbs with the large decrease in sum of nested frequency for perennials forbs due to drought. Overall, trend is slightly down for the herbaceous understory. The Desirable Components Index (see methods) rated this site as good winter range due to good shrub cover and a healthy herbaceous understory.

TREND ASSESSMENT
soil - slightly down (-1)
browse - slightly up (+1)
herbaceous understory - slightly down (-1)
winter range condition (DC Index) - good (79) Mid-level potential scale

2005 TREND ASSESSMENT

The soil trend is considered stable. Relative percent bare ground increased from 41% to 45%. Relative litter cover decreased from 26% to 20%. The erosion condition class rating was slight, with pedestaling and rills present on the site. These slight changes are not enough to warrant a change in soil trend. The browse trend is stable for mountain big sagebrush, the key species. The number of mature and decadent plants remained stable, while young plants declined. Recruitment was 7%, while seedlings were abundant with 1,040/acre. Sagebrush cover increased from 20% to 25%. Utilization has been light to moderate. The herbaceous understory trend is down due to drought. Sum of nested frequency for both grasses and forbs decreased by 27%. The Desirable Components Index (see methods) rated this site as good winter range due to good shrub cover and a healthy herbaceous understory.

TREND ASSESSMENT
soil - stable (0)
browse - stable (0)
herbaceous understory - down (-2)
winter range condition (DC Index) - good (73) Mid-level potential scale

HERBACEOUS TRENDS --
Management unit 10 , Study no: 5

Type	Species	Nested Frequency				Average Cover %		
		'88	'95	'00	'05	'95	'00	'05
G	Agropyron dasystachyum	$_{c}$195	$_{b}$131	$_{b}$147	$_{a}$69	.78	.84	.29
G	Carex sp.	$_{b}$52	$_{a}$11	$_{a}$4	$_{a}$3	.05	.00	.00
G	Koeleria cristata	$_{b}$159	$_{ab}$115	$_{a}$79	$_{ab}$122	1.95	.84	3.05
G	Poa fendleriana	$_{b}$126	$_{b}$135	$_{b}$154	$_{a}$78	1.93	2.50	2.10
G	Poa nevadensis	$_{a}$-	$_{a}$-	$_{b}$25	$_{c}$52	-	.35	1.26

Type	Species	Nested Frequency				Average Cover %		
		'88	'95	'00	'05	'95	'00	'05
G	Poa pratensis	-	1	-	-	.00	-	-
G	Poa secunda	142	120	130	100	1.89	1.56	3.06
G	Stipa comata	$_{b}$73	$_{b}$75	$_{ab}$55	$_{a}$29	.60	.64	.57
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		747	588	594	453	7.23	6.75	10.37
Total for Grasses		747	588	594	453	7.23	6.75	10.37
F	Agoseris glauca	$_{a}$-	$_{ab}$6	$_{ab}$2	$_{b}$8	.02	.04	.03
F	Allium sp.	-	2	-	-	.00	-	.00
F	Antennaria rosea	$_{c}$203	$_{c}$163	$_{b}$102	$_{a}$46	4.20	1.38	.32
F	Androsace septentrionalis (a)	-	$_{c}$79	$_{a}$10	$_{b}$39	.23	.20	.20
F	Arabis drummondi	$_{a}$-	$_{b}$10	$_{ab}$2	$_{ab}$8	.02	.00	.01
F	Astragalus convallarius	5	15	15	4	.18	.10	.04
F	Astragalus miser	12	23	28	8	.39	.42	.06
F	Astragalus spatulatus	-	8	2	5	.21	.03	.03
F	Aster sp.	$_{b}$92	$_{b}$77	$_{a}$41	$_{a}$10	.87	.27	.09
F	Astragalus utahensis	-	-	7	3	-	.04	.03
F	Castilleja flava	$_{bc}$58	$_{c}$85	$_{b}$39	$_{a}$-	.63	.34	-
F	Calochortus nuttallii	$_{a}$-	$_{b}$17	$_{a}$-	$_{b}$17	.03	-	.08
F	Crepis acuminata	$_{a}$-	$_{b}$37	$_{b}$33	$_{b}$24	.28	.30	.23
F	Cruciferae	-	3	-	-	.01	-	-
F	Cryptantha sp.	$_{b}$57	$_{a}$-	$_{a}$-	$_{a}$-	-	-	-
F	Delphinium nuttallianum	$_{a}$-	$_{c}$61	$_{a}$1	$_{b}$30	.19	.00	.11
F	Eriogonum alatum	$_{a}$-	$_{b}$14	$_{b}$21	$_{b}$9	.08	.11	.05
F	Erigeron eatonii	$_{c}$145	$_{ab}$84	$_{b}$88	$_{a}$48	1.25	.60	.35
F	Eriogonum racemosum	1	-	-	3	-	-	.03
F	Eriogonum umbellatum	18	24	27	34	.39	.26	.56
F	Gayophytum ramosissimum(a)	-	-	-	8	-	-	.02
F	Ipomopsis aggregata	1	5	-	9	.06	-	.02
F	Lappula occidentalis (a)	-	-	3	-	-	.00	-
F	Lesquerella ludoviciana	$_{a}$19	$_{b}$62	$_{b}$65	$_{b}$88	.83	.29	1.25
F	Linum lewisii	7	5	12	4	.04	.08	.00
F	Lomatium sp.	-	6	-	1	.01	-	.01
F	Lupinus argenteus	$_{b}$49	$_{b}$60	$_{ab}$43	$_{a}$22	1.40	.74	.09
F	Lygodesmia sp.	-	-	1	-	-	.00	-
F	Orthocarpus sp. (a)	-	1	1	-	.00	.03	-
F	Penstemon caespitosus	3	3	6	7	.09	.15	.16

Type	Species	Nested Frequency				Average Cover %		
		'88	'95	'00	'05	'95	'00	'05
F	Penstemon sp.	15	6	10	2	.04	.10	.04
F	Phlox austromontana	$_{b}$52	$_{b}$60	$_{a}$-	$_{b}$45	1.10	-	.94
F	Phlox longifolia	$_{b}$44	$_{b}$50	$_{b}$101	$_{a}$14	.18	1.68	.11
F	Polygonum douglasii (a)	-	$_{c}$227	$_{a}$-	$_{b}$70	.80	-	.21
F	Potentilla gracilis	-	3	4	3	.18	.06	.15
F	Senecio integerrimus	$_{a}$-	$_{b}$29	$_{a}$1	$_{b}$32	.07	.00	.48
F	Sedum lanceolatum	4	5	11	5	.03	.02	.06
F	Senecio multilobatus	-	5	2	-	.01	.00	-
F	Sphaeralcea coccinea	7	2	-	-	.00	-	-
F	Taraxacum officinale	$_{b}$20	$_{a}$12	$_{a}$4	$_{a}$2	.42	.04	.00
F	Tragopogon dubius	-	-	3	-	-	.03	-
Total for Annual Forbs		0	307	14	117	1.04	0.23	0.43
Total for Perennial Forbs		812	942	671	491	13.27	7.19	5.39
Total for Forbs		812	1249	685	608	14.32	7.42	5.82

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --
Management unit 10 , Study no: 5

Type	Species	Strip Frequency			Average Cover %		
		'95	'00	'05	'95	'00	'05
B	Artemisia tridentata vaseyana	95	99	94	16.11	20.49	25.01
B	Chrysothamnus depressus	60	66	51	3.34	1.88	2.56
B	Chrysothamnus nauseosus	1	0	1	-	-	-
B	Chrysothamnus viscidiflorus	17	11	11	.02	.18	.36
B	Gutierrezia sarothrae	8	5	6	.21	.03	.18
B	Juniperus osteosperma	0	2	1	.48	.94	.56
B	Pediocactus simpsonii	1	3	7	.00	-	.03
B	Pinus edulis	0	2	1	-	.03	.00
B	Symphoricarpos oreophilus	1	2	2	.38	.30	.18
Total for Browse		183	190	174	20.54	23.87	28.89

CANOPY COVER, LINE INTERCEPT --
Management unit 10 , Study no: 5

Species	Percent Cover '05
Artemisia tridentata vaseyana	27.58
Chrysothamnus depressus	1.63
Gutierrezia sarothrae	.10
Juniperus osteosperma	.73
Symphoricarpos oreophilus	.01

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 10 , Study no: 5

Species	Average leader growth (in) '05
Artemisia tridentata vaseyana	1.4
Chrysothamnus depressus	1.5

POINT-QUARTER TREE DATA --
Management unit 10 , Study no: 5

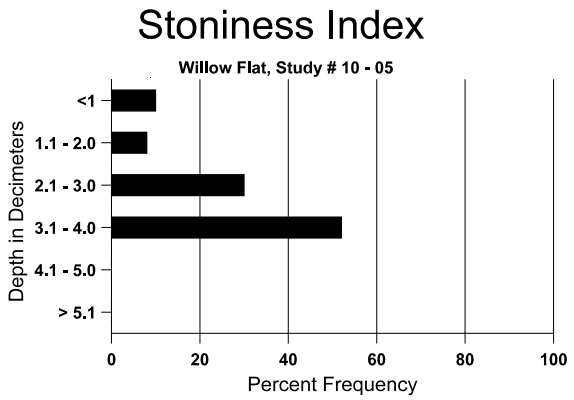
Species	Trees per Acre		Average diameter (in)	
	'00	'05	'00	'05
Juniperus osteosperma	27	55	6.0	3.9
Pinus edulis	7	21	2.7	3.5

BASIC COVER --
Management unit 10 , Study no: 5

Cover Type	Average Cover %				
	'82	'88	'95	'00	'05
Vegetation	7.50	16.75	40.15	39.23	39.87
Rock	0	0	.66	.04	.11
Pavement	0	0	.34	.66	1.11
Litter	53.50	46.75	34.04	34.51	22.88
Cryptogams	.75	1.50	3.01	3.45	.38
Bare Ground	38.25	35.00	34.59	53.58	51.52

SOIL ANALYSIS DATA --
Herd Unit 10, Study # 5, Study Name: Willow Flat

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	ppm P	ppm K	dS/m
12.8	52.4 (15.0)	7.1	30.0	40.0	30.0	2.3	1.8	204.8	0.8



PELLET GROUP DATA --
Management unit 10 , Study no: 5

Type	Quadrat Frequency		
	'95	'00	'05
Rabbit	3	9	14
Horse	-	-	1
Elk	14	20	33
Deer	7	6	10
Cattle	-	2	2

Days use per acre (ha)	
'00	'05
-	-
-	-
32 (79)	31 (76)
6 (15)	4 (10)
8 (20)	-

BROWSE CHARACTERISTICS --
Management unit 10 , Study no: 5

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia tridentata vaseyana												
82	**2533**	5200	333	2200	-	-	26	0	0	-	0	24/17
88	**16800**	1333	15200	1400	200	-	4	0	1	-	1	30/22
95	**8840**	1620	3820	4920	100	260	9	.45	1	.22	.22	25/28
00	**10060**	600	2940	5580	1540	300	22	.39	15	.19	.39	24/28
05	**7580**	1040	560	5520	1500	520	26	3	20	9	9	24/28
Chrysothamnus depressus												
82	**10599**	-	866	9733	-	-	14	3	0	-	0	4/9
88	**9599**	533	4600	3133	1866	-	27	16	19	.41	7	4/6
95	**5400**	-	680	4700	20	60	0	0	0	-	0	5/7
00	**5340**	60	540	4380	420	160	12	0	8	3	3	3/8
05	**4240**	20	160	3920	160	40	44	0	4	2	2	4/9

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Chrysothamnus nauseosus												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
95	**20**	-	20	-	-	-	0	0	-	-	0	-/-
00	**0**	-	-	-	-	-	0	0	-	-	0	-/-
05	**20**	-	-	20	-	-	0	0	-	-	0	7/7
Chrysothamnus viscidiflorus												
82	**1200**	-	-	1200	-	-	56	0	0	-	0	9/12
88	**799**	-	466	200	133	-	33	33	17	-	0	8/6
95	**500**	-	40	460	-	-	0	0	0	-	0	8/11
00	**320**	-	20	240	60	-	0	0	19	-	0	7/8
05	**300**	-	40	240	20	-	0	0	7	-	0	8/9
Gutierrezia sarothrae												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
88	**133**	-	-	133	-	-	0	0	-	-	0	5/1
95	**360**	-	60	300	-	-	0	0	-	-	0	6/7
00	**120**	-	20	100	-	-	0	0	-	-	0	4/3
05	**220**	-	-	220	-	-	0	0	-	-	0	5/8
Juniperus osteosperma												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
95	**0**	-	-	-	-	-	0	0	-	-	0	-/-
00	**40**	-	40	-	-	-	0	0	-	-	0	-/-
05	**20**	-	20	-	-	-	0	0	-	-	0	-/-
Peraphyllum ramosissimum												
82	**133**	-	-	133	-	-	0	0	-	-	0	30/32
88	**66**	-	-	66	-	-	0	100	-	-	0	28/37
95	**0**	-	-	-	-	-	0	0	-	-	0	19/21
00	**0**	-	-	-	-	-	0	0	-	-	0	19/24
05	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Pediocactus simpsonii												
82	**66**	-	-	66	-	-	0	0	-	-	0	1/2
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
95	**20**	-	-	20	-	-	0	0	-	-	0	-/-
00	**60**	-	40	20	-	-	0	0	-	-	0	-/-
05	**140**	-	-	140	-	-	0	0	-	-	0	1/2

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Pinus edulis												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
95	**0**	-	-	-	-	-	0	0	-	-	0	-/-
00	**40**	-	40	-	-	-	0	0	-	-	0	-/-
05	**20**	40	20	-	-	-	0	0	-	-	0	-/-
Symphoricarpos oreophilus												
82	**0**	-	-	-	-	-	0	0	-	-	0	-/-
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
95	**20**	-	-	20	-	-	0	0	-	-	0	14/35
00	**60**	-	-	60	-	-	0	0	-	-	0	-/-
05	**60**	-	-	60	-	-	0	0	-	-	0	12/23
Tetradymia canescens												
82	**0**	-	-	-	-	-	0	0	0	-	0	-/-
88	**66**	-	-	-	66	-	0	100	100	-	0	-/-
95	**0**	-	-	-	-	-	0	0	0	-	0	-/-
00	**0**	-	-	-	-	-	0	0	0	-	0	-/-
05	**0**	-	-	-	-	-	0	0	0	-	0	-/-